USA(93)

USDA United States Department of Agriculture

Forest Service

Intermountain Research Station

General Technical Report INT-GTR-366

December 1997

User's Guide to PCDANGER: National Fire Danger Rating System for Personal Computers

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Research Summary

PCDANGER is a personal computer application of the National Fire Danger Rating System (NFDRS) that calculates both 1978 and 1988 version fire danger indexes from daily weather observations and forecasts. Its computational routines (NFDRCALC) are the same as those used in the Weather Information Management System (WIMS), which is the current national system in the United States for daily computation of NFDRS components and indexes. PCDANGER replaces the former PC-based fire danger rating application NFDRSPC.

Although PCDANGER does not provide some of the important features available through WIMS, it does provide added local flexibility in computing and graphing fire danger-rating indexes for a small set of fire weather stations. It does not automatically interface with the National Interagency Fire Management Integrated Database (NIFMID), or the National Weather Service's Telecommunications Gateway. Therefore, it must not be seen as a substitute for WIMS. It allows WIMS users to compute independent NFDR index values from the same fire weather observations without cost or risk of corrupting the NIFMID database. This feature is useful for both troubleshooting index values and for NFDR training sessions where access to WIMS is not feasible. It is an excellent tool to evaluate the sensitivity of NFDR indexes to different weather parameters. PCDANGER also allows the user to forecast NFDR indexes beyond the next-day limit in WIMS, a helpful feature in developing weather scenarios.

Contents

	Page
Introduction	1
Installation	2
Getting Started	2
The Station Catalog	2
Weather Observations	5
Forecast Indexes	7
View Archived Weather Observations, Indexes, and Forecasts	9
System Utilities	10
References	11
Appendix A: Weather Files	12
Appendix B: PCDANGER Data Files and File Formats	13
Appendix C: Programs Using Historical Fire and Weather Information	14
Appendix D: PCDANGER Source Code	15
Appendix E: Software Availability	16

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User's Guide to PCDANGER: National Fire Danger Rating System for Personal Computers

Larry S. Bradshaw
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"Our danger measuring system may have its weak spots but the best watch in the world will not show time accurately if you do not wind it."

H. T. Gisborne, 1948

"What's 'to wind a watch'?"

Anonymous school child, 1994

Introduction

Among the risks facing fire management in the "information age" is the seduction of the fire manager by technology. As we attempt to keep pace with the rising stakes of risk exposure, the tools we develop exhibit a corresponding increase in complexity. An unfortunate side effect of this trend is the increasing commitment of time to master these tools, time which might better be spent in the field. Equally dangerous is the surreptitious desire that mastery of the tools might substitute for field experience.

Happily, this program opposes that trend. Interpretation of the components and indexes of the National Fire Danger Rating System (NFDRS) has evolved in concert with our understanding of fire in the human environment. From interagency staffing levels in suppression planning to guidelines for natural fire prescriptions, most fire managers work with the NFDRS every day. PCDANGER with its menu-driven format—which replaces the former PC-based application, NFDRSPC—has made calculating the indexes easier than taking the weather.

Several programs exist that calculate the NFDRS indexes from daily and historical weather data (appendix C). The computational routines used by the program NFDRCALC (appendix D) are used by both PCDANGER and the Weather Information Management System (WIMS) (USDA Forest Service 1995) housed at the National Computer Center in Kansas City, MO. They also form the basis of several commercially available fire weather systems.

Although PCDANGER does not provide some of the important features available through WIMS, it does provide local flexibility in computing and graphing fire danger-rating indexes. It does not automatically interface with the National Interagency Fire Management Integrated Database (NIFMID) or the National Weather Service's Telecommunications Gateway. Therefore, it must not be seen as a substitute for WIMS. PCDANGER was designed to accommodate the daily danger-rating activities of a small (up to 32) set of weather stations. It computes fire danger indexes for both the 1978 and 1988 versions of the NFDRS; you may select either or both. Although it does not allow for Special Interest Groups (SIGs) or area-weighting of stations, it enables the user to forecast fire-danger indexes for any number of days, to graph the observed weather, and to compute and forecast indexes.

By necessity, PCDANGER assumes that the user has a basic understanding of the DOS computer operating system. If you have an IBM-compatible computer and can copy a file, you will have no problem installing PCDANGER and operating this program. Likewise, PCDANGER assumes the user is familiar with the NFDRS. Though the help screens are comprehensive, the program cannot interpret the components and indexes for you.

Installation

Installation of the PCDANGER program requires about one free megabyte on the hard drive and about 600K memory. The following is an example of how you might do the installation in DOS. Bold type indicates your key entries. You may use the Window File Manager, or Windows 95 Explorer to do the equivalent in Windows.

1. Create a directory on the hard drive for the program. 'FDR' is short and sweet, and we will use it for the purposes of this user's guide.
   Type and enter each command:
   MD \FDR
   CD \FDR
2. Copy the file FDR_SEND.EXE from the install disk (A:) into the directory. This is a self-extracting file (in other words, a compressed file that automatically expands).
   Type and enter:
   Copy A:FDR_SEND.EXE
3. Extract the program files.
   Type and enter:
   FDR_SEND

The program files are expanded and installation is complete.

4. If you wish, you may delete FDR_SEND.EXE from the hard drive.
   Type and enter:
   DEL FDR_SEND.EXE

Getting Started

To start the program, type **PCDANGER** from the FDR directory. For convenience, you may rename the executable file 'FDR' or some other abbreviation to shorten the command keystrokes.

Type and enter:
REN PCDANGER.EXE FDR.EXE

Key Functions

↵ Enter	Accepts field entry and advances cursor to next field.
↑ Up arrow	Previous field.
↓ Down arrow	Next field.
→ Right arrow	Next space within field.
← Left arrow	Previous space within field.
Page Down	Next station catalog (does not save changes).
Page Up	Previous station catalog (does not save changes).
Esc	Back out without saving changes.
F1	Process entries (save changes).
Shift F1	Help.
Shift F2	Index of input options.

The Main Menu

The PCDANGER main menu screen is illustrated in figure 1. Because the NFDRS computes components and indexes from weather observed regularly at fixed locations, the station location must be described before recording weather observations. This description is called the station catalog. To bring the station catalog to the screen from the main menu, choose **6. Enter Catalog Information**.

Note: If you will be entering weather observations for more than one station, the program will present the stations to you in the order that they were initially cataloged. If you are going to designate one of your stations as an associated station, the associated station must be cataloged before the station that will borrow its observation (see discussion of associated stations).

To choose any of the eight options in the main menu, you may either scroll down with the arrow key, or enter the number of the option you wish to choose, and press Enter.

The Station Catalog

The station catalog screen is shown in figure 2. Each gray block where information can be entered is called a field. The gray bar across the bottom of the screen displays field prompt messages. These give brief hints about the information to be entered and its correct format. Error and information messages will appear below the field prompts. Some fields are validated and will not let you exit (forward or back) without a valid entry. If you are in a validated field and can't back up to a previous field, try putting a valid entry in the field and hit the up arrow key.

The station catalog describes the station's physical location and the representative fuels for the fire danger rating area. Most danger-rating model assumptions and interrelationships are discussed in the Help screens to assist with decisions between options and initialization values.

PCDANGER uses the **station name** as the primary reference for the weather station. The **station number (ID)** is associated with the name. If you are working with national fire weather network stations, use the assigned network number. If you are not working with established stations, you may assign any number you wish. If you enter the name of a station that is already in the catalog file, you will receive a message informing you that the station name already exists. You must enter a new name. If you wish to view a list of stations already cataloged, press Shift F2 (Index). If you would like to view or change the catalog information for the station that you just tried to reenter, you must Escape to the main menu and press **7. View/Edit Catalog Information**.

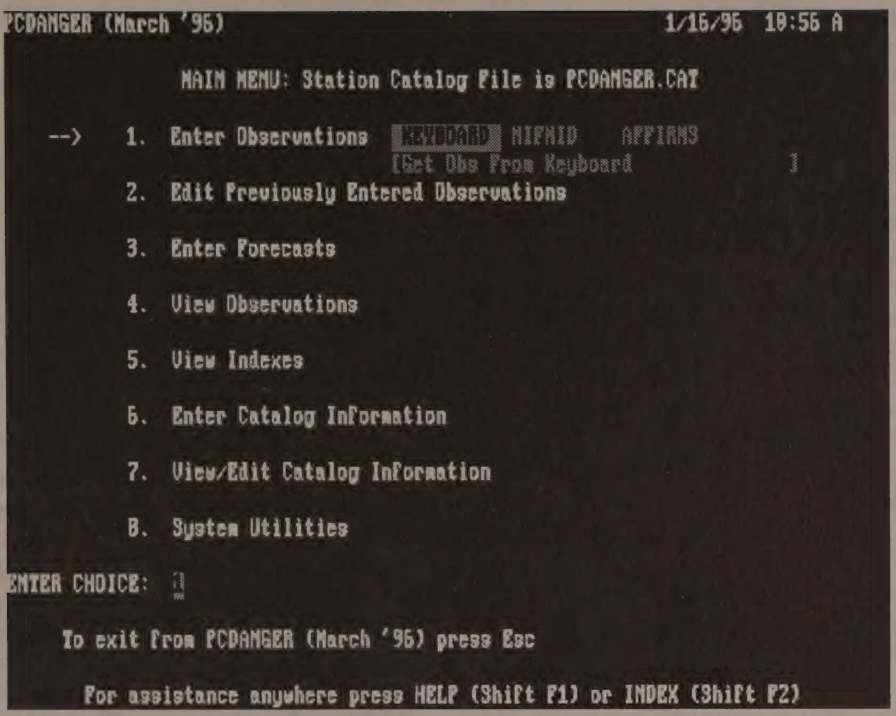
PCDANGER (March '95) 1/16/96 10:56 A
MAIN MENU: Station Catalog File is PCDANGER.CAT
--> 1. Enter Observations KEYBOARD NIFMID AFFIRMS
[Get Obs From Keyboard]
2. Edit Previously Entered Observations
3. Enter Forecasts
4. View Observations
5. View Indexes
6. Enter Catalog Information
7. View/Edit Catalog Information
8. System Utilities
ENTER CHOICE: 1
To exit from PCDANGER (March '95) press Esc
For assistance anywhere press HELP (Shift F1) or INDEX (Shift F2)

Figure 1—PCDANGER Main Menu. Note that current catalog is PCDANGER.CAT.

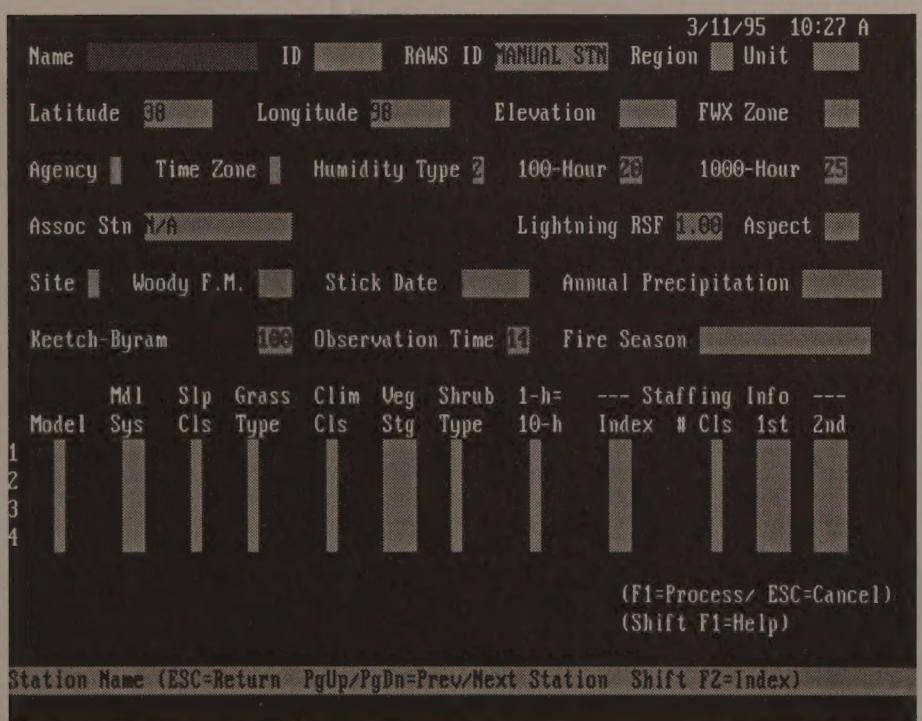
3/11/95 10:27 A
Name ID RAWS ID MANUAL STN Region Unit
Latitude 00 Longitude 00 Elevation FWX Zone
Agency Time Zone Humidity Type 2 100-Hour 20 1000-Hour 25
Assoc Stn N/A Lightning RSF 1.00 Aspect
Site Woody F.M. Stick Date Annual Precipitation
Keetch-Byram 100 Observation Time 13 Fire Season
Model Mdl Sys Slp Cls Grass Type Clim Cls Veg Stg Shrub Type 1-h= 10-h --- Staffing Index # Cls Info 1st 2nd ---
1
2
3
4
(F1=Process/ ESC=Cancel)
(Shift F1=Help)
Station Name (ESC=Return PgUp/PgDn=Prev/Next Station Shift F2=Index)

Figure 2—The station catalog screen (Option 6. of the Main Menu), showing default entries and the field message at the bottom of the screen for the name field.

Any entry in the **RAWS ID** field other than MANUAL STN will access the **Assoc Stn** (Associated Station) field. Designate an associated station to provide inputs for those weather variables that are not measured by your remote instrumentation, such as the state of the weather or the measured 10-h fuel moisture value. When weather observations for the present station are entered, the program will pull associated observations from the station that you designate here and mark them with an asterisk. The station from which you wish to pull the observations must already exist in the catalog. When entering today's observations for a number of stations, the program presents the stations to you in the order in which they were cataloged. This ensures that current weather observations will have been entered for the associated station before the present station uses them.

Default values for certain fields are entered for you. While these values enable program operation, to have relevance, the entries must be site-specific. For example, the default station **Latitude** is the geographic center of the continental United States. However, latitude contributes to the computation of day length, used in turn to calculate the large fuel moistures. The effects of using default values may not be noticeable on components and indexes weighted primarily toward daily observations (spread component or ignition component). However, the difference can be significant in the energy release component (ERC), which reflects seasonal trends through the 100-h and 1,000-h fuel moistures (Burgan 1976).

Up to four **fuel models** may be defined per station, from either the 1978 or 1988 NFDRS. Not all fields are mandatory for each fuel model set. Prompt messages indicate which fields are required for which version. You also have the option to designate all the attributes of the fuel model, but leave the fuel model field blank. This has the effect of turning off the index calculations for that model without having to delete all its attributes. If you do designate the parameters for a blank fuel model field, you will receive a message: "NFDR not computed for this line. Other values intact." Because the indexes are fuel-model specific, changing the fuel model in a station catalog reinitializes all calculations for that model. For complete narrative descriptions of the 1978 fuel models, see Deeming and others (1977, p. 32). For comparison of the 1978 and 1988 fuel model parameters, see Burgan (1988, pp. 21, 22).

Designating the current vegetation stage (**Veg Stg**) for 1978 fuel models is mandatory. After a weather record has been established, the current stage of the vegetation is shown in the index display as a letter following the herbaceous fuel moisture (Pregreenup [PRE], Greenup [GRN], Transition [TRN], Cured [CUR], or Frozen [FRE]). The vegetation stage display is illustrated in figure 3 for the two 1978 fuel models under the column labeled "HRB." As you enter weather observations through the season, you will receive

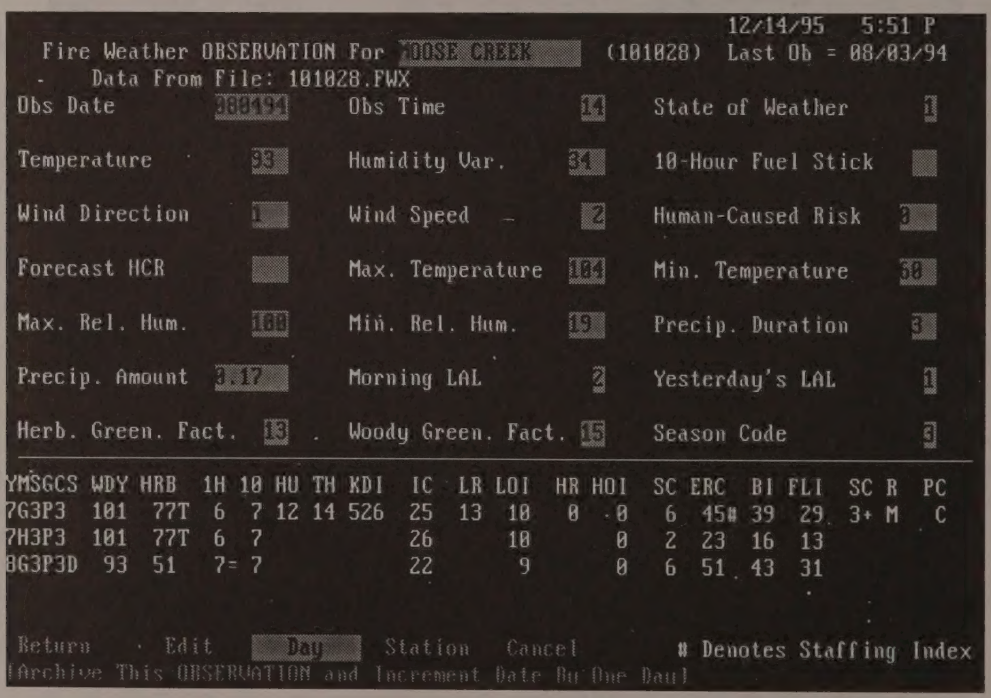
12/14/95 5:51 P
Fire Weather OBSERVATION For MOOSE CREEK (101028) Last Ob = 08/03/94
Data From File: 101028.FWX
Obs Date 080194
Obs Time 14
State of Weather 1
Temperature 33
Humidity Var. 34
10-Hour Fuel Stick
Wind Direction 1
Wind Speed 2
Human-Caused Risk 3
Forecast HCR
Max. Temperature 104
Min. Temperature 38
Max. Rel. Hum. 100
Min. Rel. Hum. 19
Precip. Duration 3
Precip. Amount 3.17
Morning LAL 2
Yesterday's LAL 1
Herb. Green. Fact. 13
Woody Green. Fact. 15
Season Code 3
YMSGCS WDY HRB 1H 10 HU TH KDI IC LR LOI HR HOI SC ERC BI FLI SC R PC
7G3P3 101 77T 6 7 12 14 526 25 13 10 0 0 6 45# 39 29 3+ M C
7H3P3 101 77T 6 7 26 10 0 2 23 16 13
8G3P3D 93 51 7= 7 22 9 0 6 51 43 31
Return Edit Day Station Cancel # Denotes Staffing Index
(Archive This OBSERVATION and Increment Date By One Day)

Figure 3—Completed observation entry with computed indexes. Some values which do not change between models are not repeated down the column. The menu bar at the bottom and the menu prompt direct your next move.

messages informing you that greenup and curing are complete for your 1978 fuel models. If you want to force greenup, enter the vegetation stage as green (GRN). The program will prompt you to specify the greenup date, taking the current system date as the default. It will then verify the date you specify as the greenup date for any additional 1978 fuel models in the current station.

Selection of a **Staffing Index** upon which to base staffing classes is optional, but if an index is designated, assigning the number of staffing classes (**# Cls**) and the values at the breakpoint percentiles (**1st** and **2nd**) is mandatory. When a staffing class index has been designated, it is displayed followed by a # (see display of ERC, fig. 3).

Note: Computation of the Staffing Class (SC), Adjective Rating (R) and the R6 Industrial Precautions Class (PC) are based on the same criteria as in WIMS. These are documented in the WIMS User's Guide (USDA Forest Service 1995, appendix E), and the AFFIRMS Manual (Helfman and others 1987, appendix F). Standard methods for computing percentiles upon which to base staffing classes is documented in the FIREFAMILY 1988 (Main and others 1990) and KCFAST (USDA Forest Service 1996a) publications. Since the FIREFAMILY 1988 publication, a PC version of FIREFAMILY (California Department of Forestry 1994) has greatly simplified this process. Current work at the Intermountain Fire Sciences Laboratory (FIRES: a program for fire danger rating analysis. Andrews and Bradshaw 1997) provides improved methods for staffing class determination, and processing systems will likely be modified to reflect these changes.

Entries in the station catalog fields will be saved only if you hit F1 or fill out the entire screen and answer 'Y' to the final execute prompt. If you answer no (N) to the execute prompt, all of the information in the fields will be erased, and the cursor will return to the Name field at the top of the screen. You may Escape out of the screen at any time, and none of the entries will be saved. This also applies when making edits to the station catalog: if you make changes to the catalog information, those changes will be saved only if you hit F1 or scroll through the entire screen and answer yes to execute. When the execute command is processed, a message will indicate that the station catalog has been added or updated. Press Escape to return to the main menu. A completed catalog screen is illustrated in figure 4.

For thorough discussions of the NFDRS fuel models, see Deeming and others (1977), Bradshaw and others (1983), and Burgan (1988). For a more complete explanation of weather station set-up and maintenance, see Fischer and Hardy (1976) and Finklin and Fischer (1990).

Weather Observations

After the weather station catalog has been established, weather observations for that station may be entered. This can be accomplished either manually from the keyboard or by reading observations from a data file.

Entering observations from the keyboard: From the main menu, enter **1. Enter Observations** and select **KEYBOARD** from the pop-up menu.

Entering observations from a weather data file: From the main menu, enter **1. Enter Observations** and select **NIFMID** or **AFFIRMS** from the pop-up menu.

Selecting NIFMID or AFFIRMS tells the program to look for a weather file of the specified format from which to pull observation data. This file must reside in the same directory as the PCDANGER program (such as C:\FDR\101028.FWX; for information regarding data file naming conventions and formatting standards, see appendix A). When the program finds the file, it displays a message below the station name to indicate which file is in use (fig. 3).

Once you have selected the method of entering weather observation data, you are presented with the observation entry screen (fig. 5). The first station in the catalog is the default station on the screen. The Page Up/Page Down keys enable you to scroll through stations, or the index (Shift F2) can provide you with a complete list from which to choose. After selecting a station, the station ID number is shown in parentheses. The program displays the date of the station's last archived weather observation to the right of the station ID. In figure 5, none have been archived yet (00/00/00). Once an archived weather record has been established, the date following the last archived observation is provided as the default observation date.

If you read data from a file, the field values will be filled in for you when you specify the date. When entering observations manually, help screens (Shift F1) and an index of valid entries (Shift F2) are available to assist with input.

The first observation date entry produces a prompt message stating "yesterday's observation not found, no persistence applied." During subsequent data entry sessions, this message alerts you that an interruption has occurred in the continuity of your weather record. As long as your weather records are continuous, PCDANGER will carry forward several fields that change little from day to day, such as LAL (Lightning Activity Level), risk factors, state of the weather, and greenness factors. Any interruption of more than 30 days will reinitialize all NFDRS calculations.

The program will cross-check certain values for consistency; for example, it will not allow input of a maximum relative humidity value that is lower than

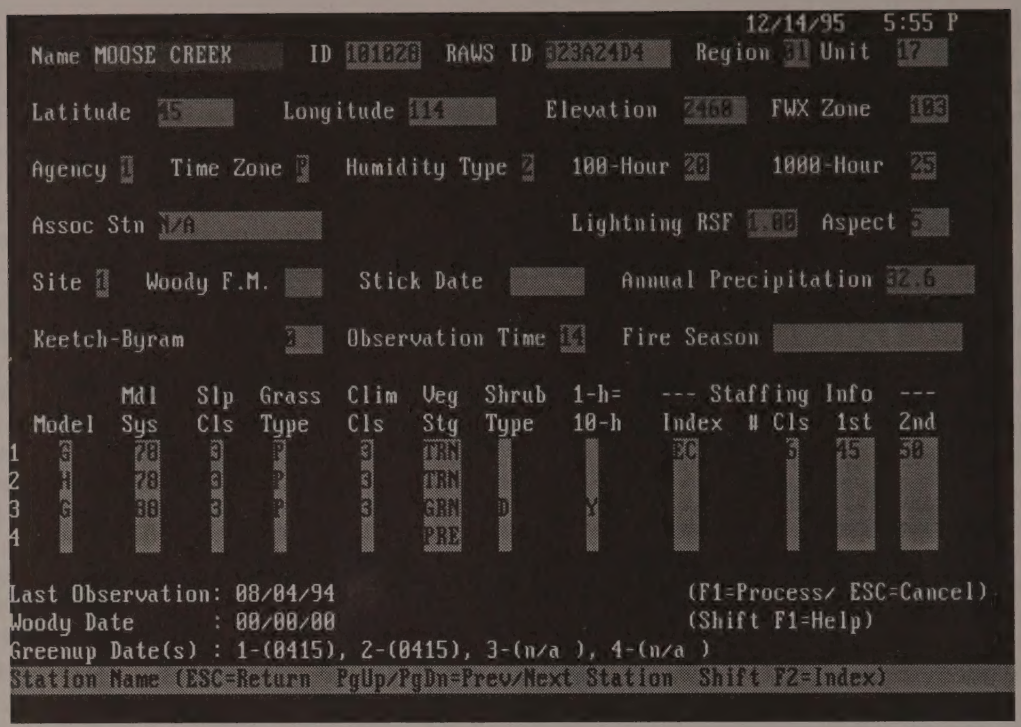
12/14/95 5:55 P
Name MOOSE CREEK ID 101020 RAWS ID 923A24D4 Region 31 Unit 17
Latitude 45 Longitude 114 Elevation 2468 FWX Zone 103
Agency 1 Time Zone 7 Humidity Type 2 100-Hour 20 1000-Hour 25
Assoc Stn N/A Lightning RSF 1.00 Aspect 5
Site 1 Woody F.M. Stick Date Annual Precipitation 32.6
Keetch-Byram 3 Observation Time 14 Fire Season
Mdl Slp Grass Clim Veg Shrub 1-h= --- Staffing Info ---
Model Sys Cls Type Cls Sty Type 10-h Index # Cls 1st 2nd
1 G 78 3 2 3 TRN 60 3 45 50
2 H 78 3 2 3 TRN
3 G 80 3 2 3 GRN D Y
4 PRE
Last Observation: 08/04/94 (F1=Process/ ESC=Cancel)
Woody Date : 00/00/00 (Shift F1=Help)
Greenup Date(s) : 1-(0415), 2-(0415), 3-(n/a), 4-(n/a)
Station Name (ESC=Return PgUp/PgDn=Prev/Next Station Shift F2=Index)

Figure 4—Completed station catalog screen. Note that green-up date is not specified for 1988 fuel model system.

the current relative humidity. If you enter an unreasonable value, the cursor will jump back to the initial entry (in this case, the relative humidity field) and offer you the opportunity to correct it. After confirming the relative humidity value, the cursor returns to the maximum humidity field. For optional data fields, PCDANGER will allow blanks.

When the weather input is complete, either press 'enter' following input of the season code, or press F1 from anywhere in a completed screen. The NFDRS components and indexes are calculated and displayed across the bottom third of the screen, along with a menu bar that guides your next step. A completed observation screen with NFDR components is shown in figure 3.

The cursor is now positioned in the menu bar at the bottom of the screen. From here you may proceed in one of five directions:

Return—**archives** the observation that you have just completed, and returns you to the main menu.

Edit—allows you to edit the current observation fields.

Day—**archives** the observation that you have just entered, and returns you to the top of a new observation screen for the same station, the following day.

Station—**archives** the observation that you have just completed and returns you to the top of a new observation screen for the same day, for next station in the catalog.

Cancel—does not archive the current observation screen, and returns you to the main menu.

Column heading abbreviations for the index display are as follows:

Y	Model year
M	Fuel model
S	Slope class
G	Grass type
C	Climate class
S	Shrub type
WDY	Woody fuel moisture
HRB	Herbaceous fuel moisture
1H	1-hour fuel moisture
10	10-hour fuel moisture
HU	100-hour fuel moisture
TH	1,000-hour fuel moisture
KDI	Keetch-Byram Drought Index
IC	Ignition component
LR	Lightning risk
LOI	Lightning fire occurrence index
HR	Human-caused risk
HOI	Human-caused fire occurrence index

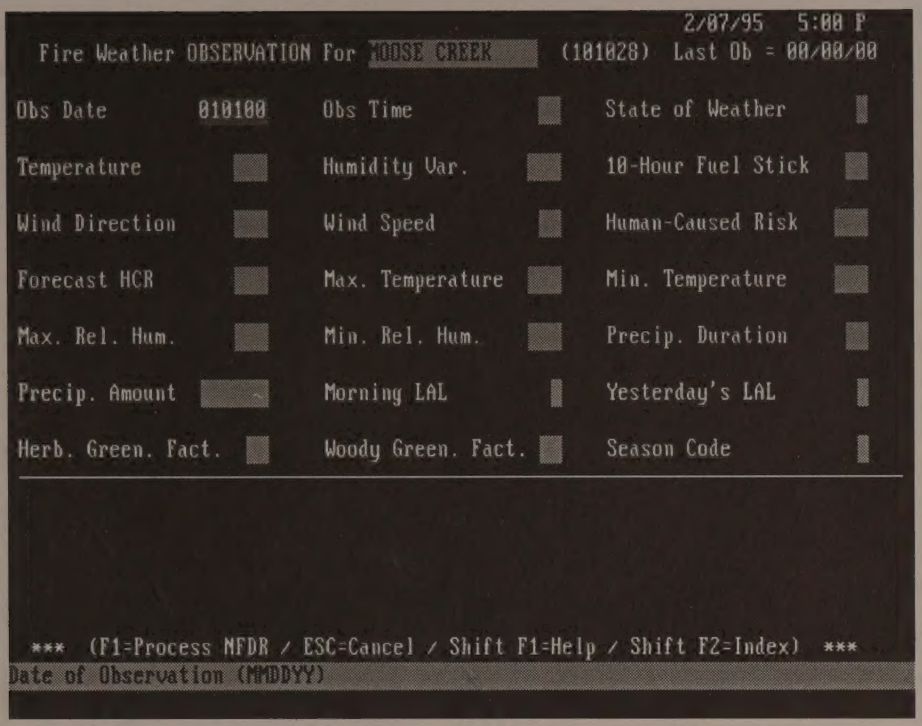

Figure 5—Example of an initial weather observation screen. The cursor is positioned on the **Obs Date** field, and the field prompt message at the bottom of the screen indicates the correct date format.

SC	Spread component
ERC	Energy release component
BI	Burning index
FLI	Fire load index
SC	Staffing class
R	Adjective fire danger rating
PC	Industrial precautions class

Editing archived observations: PCDANGER allows you to edit previously entered fire weather observations and recalculate indexes from the edited date through the most recent archived observation. To edit an archived observation, from the main menu, enter **2. Edit Archived Observations.**

The edit observation screen is the same as the enter observation screen (fig. 5). First select the station, then the date of the observation to be edited. The observation for that date will be displayed on the screen for editing. When you have completed your edits, press F1 (process) and the new NFDR indexes are displayed across the bottom portion of the screen. You will then be given the option of recalculating daily indexes from the currently edited day forward.

Forecast Indexes

You may enter forecasted weather values or trends in order to forecast NFDRS components and indexes. From the main menu, press **3. Enter Forecasts** to access the forecast screen.

The program assumes the forecast date to be tomorrow. After specifying the station and accepting the date (press Enter), the program displays today's observations across the bottom of the screen, as illustrated in figure 6. You may input actual values forecast for tomorrow's weather, or you may enter a trend of $+x$ or $-x$, where x is the number of units change for that variable. The + or – specifies that a trend is to be projected. For example, entering +5 in the temperature field indicates that tomorrow's temperature will be 5° higher than today's, whereas just entering 5 in the temperature field indicates that tomorrow's temperature will be 5°. A persistence forecast can be entered as either +0 or –0. Once the required fields are entered or F1 is pressed, the forecast weather is processed and the forecast NFDR indexes are displayed on the bottom portion of the screen (fig. 7).

The forecast module allows you to forecast the NFDRS indexes for an unlimited number of days. As in the observation screen, the menu bar at the bottom of the screen controls the next step. 'Return', 'Day', and 'Station' archive the forecast. 'Edit' and 'Cancel' do not. If you select 'Day', you may build on the present forecast and project another day out.

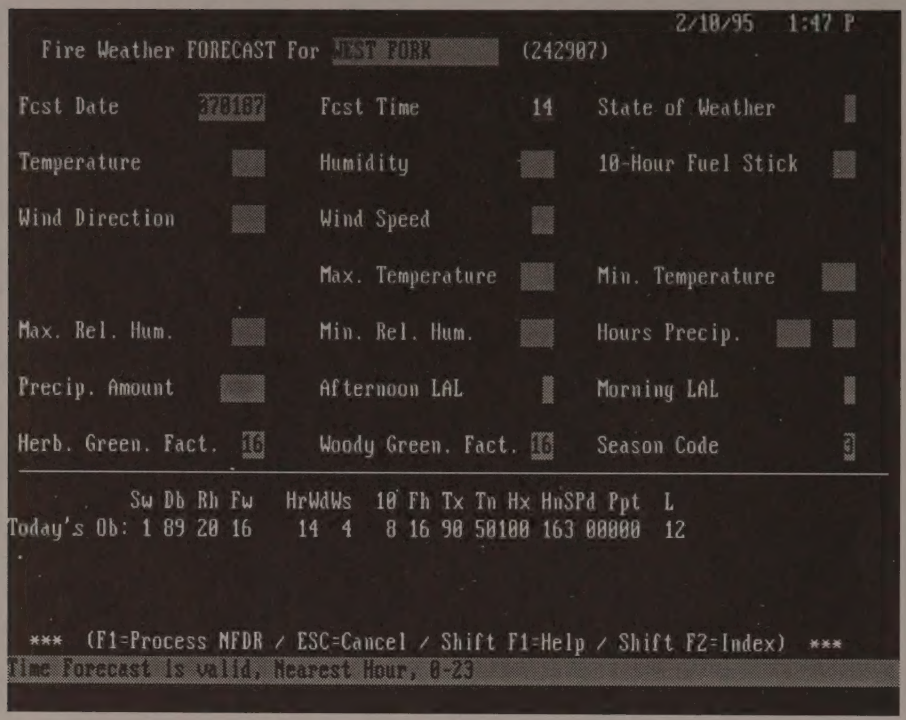
2/10/95 1:47 P
Fire Weather FORECAST For WEST FORK (242907)
Fcst Date 970107
Fcst Time 14
State of Weather
Temperature
Humidity
10-Hour Fuel Stick
Wind Direction
Wind Speed
Max. Temperature
Min. Temperature
Max. Rel. Hum.
Min. Rel. Hum.
Hours Precip.
Precip. Amount
Afternoon LAL
Morning LAL
Herb. Green. Fact. 16
Woody Green. Fact. 16
Season Code 3
Sw Db Rh Fw HrWdWs 10 Fh Tx Tn Hx HnSPd Ppt L
Today's Ob: 1 89 20 16 14 4 8 16 90 50100 163 00000 12
*** (F1=Process NFDR / ESC=Cancel / Shift F1=Help / Shift F2=Index) ***
Time Forecast Is valid, Nearest Hour, 0-23

Figure 6—Empty forecast entry screen, showing display of today's observation in the bottom portion of the screen. Note that the herbaceous and woody greenness factors (Fh and Fw in observation display) are carried forward for you.

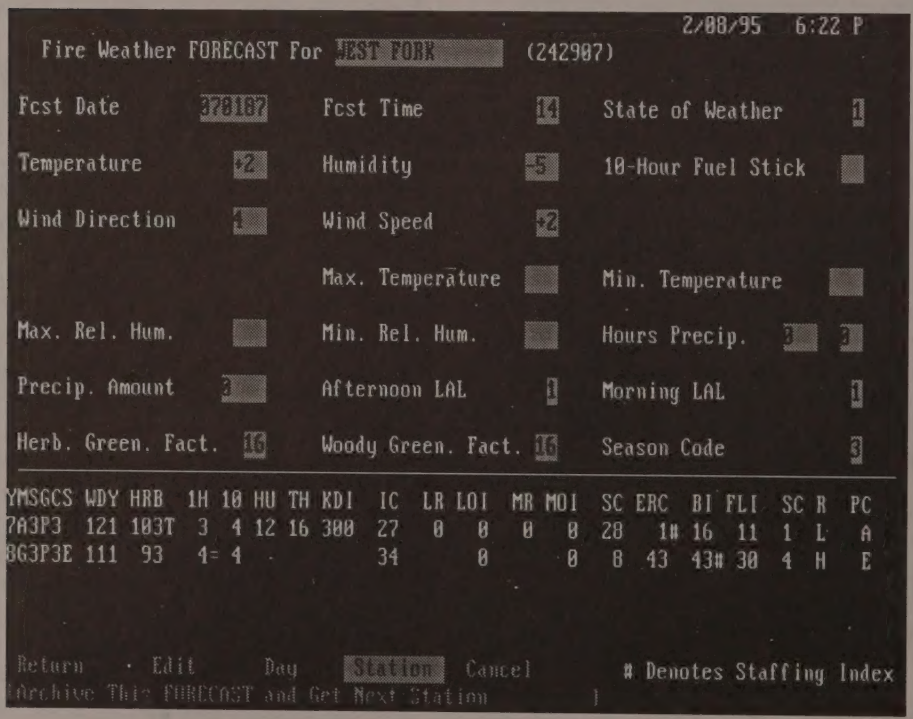
2/08/95 6:22 P
Fire Weather FORECAST For WEST FORK (242907)
Fcst Date 970107
Fcst Time 14
State of Weather 1
Temperature +2
Humidity -5
10-Hour Fuel Stick
Wind Direction 1
Wind Speed +2
Max. Temperature
Min. Temperature
Max. Rel. Hum.
Min. Rel. Hum.
Hours Precip. 3 3
Precip. Amount 3
Afternoon LAL 1
Morning LAL 1
Herb. Green. Fact. 16
Woody Green. Fact. 16
Season Code 3
YMSGCS WDY HRB 1H 10 HU TH KDI IC LR LOI MR MOI SC ERC BI FLI SC R PC
7A3P3 121 103T 3 4 12 16 300 27 0 0 0 0 28 1# 16 11 1 L A
8G3P3E 111 93 4= 4 34 0 0 8 43 43# 30 4 H E
Return · Edit Day Station Cancel # Denotes Staffing Index
Archive This FORECAST and Get Next Station

Figure 7—Trend forecast entry that shows a 2 °F increase in tomorrow's observation time temperature, and a 5 percent decrease in relative humidity. Resulting forecast indexes are displayed across bottom third of screen.

View Archived Weather Observations, Indexes, and Forecasts

PCDANGER provides three formats to view archived data: (1) tabular by date, sorted by station, (2) tabular by station, sorted by date, and (3) graphically. From the main menu, select 'Tables'.

Tables

Selecting **1. View Indexes in Tabular Format, Ordered by Date**, gives you a table of indexes for all stations sorted by date, with a secondary sort by station. A submenu asks you to specify which dates you would like to see. All dates is the default.

Selecting **2. View Indexes in Tabular Format, Ordered by Station**, gives you a table of indexes for all dates sorted by station. A submenu asks you to specify which stations you would like to see. All stations is the default. An example of a tabular display of indexes ordered by station is shown in figure 8. The tabular display of weather observations is similar.

Graphs

Selecting **3. View Indexes in Graphic Format**, allows you to graph your archived indexes by specifying graph display parameters (fig. 9). In this screen you may specify up to four variables to graph. Select any stations for which you have archived indexes. You may specify whether to display lines representing the Level 1 and 2 percentile values as defined in the station catalog for each station/model/index combination. In the **Model** field, use the index function (Shift F2) to enter valid model configurations for the specified station. Any of the NFDRS calculated components, indexes, or fuel moistures are available for display. The **Plot** field allows you to toggle any of the four lines on or off. Your commonly graphed configurations can be saved by answering 'y' to the 'Update Configuration File' prompt and entering a meaningful file name in the **Save As** field. These can later be retrieved using the index function (Shift F2).

Stn	Date	YMSGCSI	WDY	HRB	1H	10	HU	TH	KBD	IC	HOI	LOI	SC	ERC	BI	FLI	STF	ADJ
0867049501	09	7N1P3	200	10	10	16	20	25	236	5	0	0	8	8	21	15	2	L
0867049501	10	7N1P3	200	9	9	13	19	25	242	7	0	0	7	10	22	16	2	L
0867049501	11	7N1P3	200	10	10	14	18	25	252	7	0	0	10	9	24	17	3	M
0867049501	12	7N1P3	200	9	9	14	18	24	263	7	0	0	8	10	23	16	2	L
0867049501	13	7N1P3	200	9	9	14	17	24	274	8	0	0	11	10	26	18	3	M
0867049501	14	7N1P3	200	21	21	42	19	24	286	0	0	0	3	0	0	0	1	L
0867049501	15	7N1P3	200	8	8	16	20	24	243	10	0	1	11	9	25	10	3	M
0867049501	16	7N1P3	200	8	8	16	19	24	246	6	0	0	6	9	18	13	2	L
0867049501	08	7N1P3	70	10	10	17	21	25	251	11	0	1	47	12	56	40	5	H
0867049501	09	7N1P3	200	10	10	16	19	25	256	5	0	0	0	8	21	15	2	L
0867049501	10	7N1P3	200	9	9	13	18	25	262	7	0	0	7	10	22	16	2	L
0867049501	11	7N1P3	197	10	10	14	18	24	271	7	0	0	10	9	24	17	3	M
0867049501	12	7N1P3	194	20	9	14	17	24	281	7	0	0	9	10	23	16	2	L
0867049501	13	7N1P3	191	29	9	14	17	24	292	10	0	1	14	10	30	21	3	M
0867049501	14	7N1P3	190	50	21	42	19	23	303	0	0	0	3	0	0	0	1	L
0867049501	15	7N1P3	192	50	8	16	20	24	260	11	0	1	14	10	29	21	3	M
0867049501	16	7N1P3	191	61	8	16	19	24	263	6	0	0	6	9	19	13	2	L
0867049501	17	7N1P3	189	71	10	15	19	23	270	3	0	0	3	9	13	9	2	L
0867049501	18	7N1P3	187	80	10	15	18	23	278	3	0	0	3	0	12	9	1	L
0867049501	19	7N1P3	185	87	8	15	18	23	287	9	0	0	13	10	27	19	3	M
0867049501	20	7N1P3	182	94	6	14	17	23	296	10	0	1	22	13	40	28	3	M
0867049501	21	7N1P3	179	103	10	13	17	22	301	4	0	0	5	10	10	13	2	L
0867049501	22	7N1P3	172	106	8	12	16	21	306	10	0	1	15	12	34	24	3	M

Rec. 272 of 310: Valid Keys: <ESC> <PgUp> <↑> <PgDn> <↓> <Home> <End>

Figure 8—An example of indexes displayed in tabular format ordered by station.

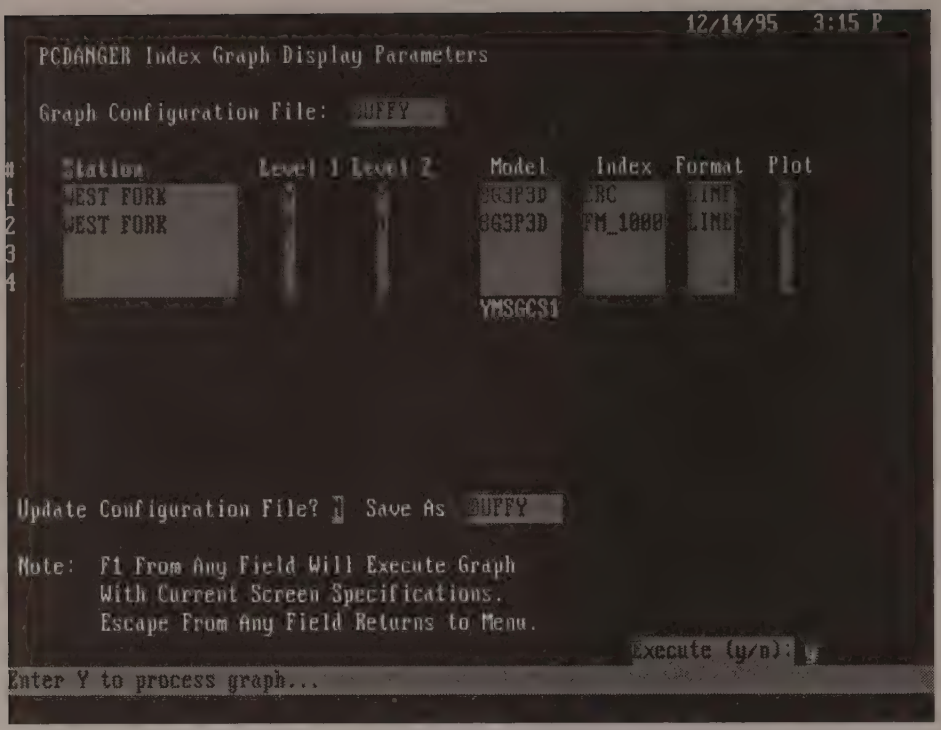

Figure 9—The screen in which you specify which variables you would like to graph.

Once you have set the graph parameters, pressing F1 will display the graph as illustrated in figure 10. A menu bar at the top of the screen lets you print the graph or return to the graph parameter screen. Return is the default. If you receive the message 'Problem: No Records Selected...', you have selected a station that has no archived records of the type specified in the graph parameter setup.

If you want to print the graph, select **Print** from the menu bar. If your printer has not been configured, the program will ask you for the proper settings (see note under system utilities regarding printer configuration and parameters). If you do not know which port you are set up for, LPT1 is usually a good guess. If your first choice is incorrect, the program will give you the message that your printer is off line. Check the printer to ensure that you're plugged in, turned on, and connected. If it is not off line, change the configuration to another port through option **8. System Utilities** in the main menu. When using PCDANGER in the Windows environment, using the Print Screen key to capture the screen image to a bitmap on the clipboard works well. The image can be pasted in your favorite program and printed using the Windows drivers.

System Utilities

1. Export Weather Observations to NIFMID/PCFIRDAT Format: This utility will create a standard NIFMID-formatted file of your archived weather observations for selected stations. A pop-up menu will prompt you for the new file name. The file will be sorted by station number + date. The data format is illustrated in appendix B.

2. Export NFDR Indexes to a File: This utility will create a file of your archived indexes for selected stations. A pop-up menu will prompt you to specify the new file name. The file will be sorted by station number + date. The data format is illustrated in appendix B.

3. Set-up Printer Configuration for Graphics Output: Printer set-up is a quick utility that asks you for the information that PCDANGER needs to properly configure your printer. It asks for: (1) the type of printer, (2) which direction to orient the paper, and (3) printer port.

Note: The graphics printer utility used in PCDANGER is a primitive tool. Experience has shown that lower density print selection prints much faster and many times better than the higher density selections, particularly on the laser printers. For nonlaser printers you'll have to experiment for the best results if exact matches are not in the printer list.

4. Create an Empty Station Catalog File: This utility allows you to create a file to house another 32-station catalog. To do so, simply type the name (using standard DOS file-naming conventions) of the new catalog file at the prompt. To start the program with the new catalog, at the DOS command prompt in the FDR directory, type **PCDANGER newfile**, where newfile

Figure 10—Graph for the West Fork station from the parameters illustrated in figure 9. The horizontal lines are the 90th and 97th percentile ERC's defined in the station catalog. The left y-axis (1) corresponds to ERC, as indicated in the legend, and the right y-axis (2) scales FM_1000.

is the file name of your new catalog. The main menu title bar verifies the name of the catalog file in use.

5. Shell to DOS: Memory permitting, you will be put in a DOS shell with your standard DOS prompt. When finished working in DOS, type **exit** to return to the PCDANGER program.

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Appendix A: Weather Files

If you plan to read data from a weather file, it is helpful to know the date ranges for which you have observations. This ensures that the date you enter in the field exists in the file.

NIFMID (National Integrated Fire Management Interagency Database)

If you retrieved your weather data through WIMS, your data follows the NIFMID format. PCDANGER will read a NIFMID-formatted data file with the following rules:

1. The file must reside in the same directory as PCDANGER.
2. The file must have an '.FWX' extension.
3. The file name must be the six-digit station ID as defined in the station catalog (for example, 101028.FWX for Moose Creek).
4. The file should have any extraneous header information removed. (The CLEAN utility in KCFAST will do this.)

To read in weather observations from a NIFMID-formatted file, select main menu option **1. Enter Observations** and select **NIFMID** from the pop-up menu. Select a cataloged station and enter a date in the weather observation entry screen. PCDANGER will look for that date in the file and load the observation values into the appropriate fields.

AFFIRMS

The AFFIRMS format is a standard format that older processing systems may generate. It is a two-record format, for example:

DATE 95,04,18
OBS 101028 13 M 79 32 M M 225 4 2 48 48 73 25 0 0.00 M M
DATE 95,04,19
OBS 101028 13 M 69 48 M M 315 3 3 81 47 94 29 0 0.00 M M

PCDANGER will read an AFFIRMS-formatted data file with the following rules:

1. The file must reside in the same directory as PCDANGER.
2. The file must have an '.ADF" extension.
3. The file name must be the six-digit station ID as defined in the station catalog (such as 101028.ADF for Moose Creek).

To read in weather observations from an AFFIRMS-formatted file, select main menu option **1. Enter Observations** and select **AFFIRMS** from the pop-up menu. Select a cataloged station and enter a date in the weather observation entry screen. PCDANGER will look for that date in the file and load the observation values into the appropriate fields.

Obtaining Fire-Weather Data Files

WIMS users have two methods to obtain files containing fire weather observations for use by the PCDANGER program. The preferred method is to use the KCFAST (USDA Forest Service 1996a) program, which submits a batch ORACLE query to WIMS and downloads NIFMID-formatted fire weather observations. This file, when given a name as described by the aforementioned NIFMID file-naming convention, can be read directly by PCDANGER.

An alternate method is to use WIMS interactively and display observations (DOBS) for a selected station and date range. The query is then captured (WIMS command CTRL-F2 on a Data General terminal, SHFT-F2 from a PC terminal) in a WIMS file that is stored in your PFILE directory. This file can be downloaded to your local computer (PC or DG), but it retains the same format as seen on the WIMS screen.

Included with PCDANGER is the utility program WIMS2PC. This program will reformat a captured WIMS observation table that has been printed PRINTed (DG) or SENT (SIMPC) into the NIFMID data file format. The file can then be read by PCDANGER.

To use the WIMS2PC utility program:

1. Copy your screen-formatted weather file into the FDR directory.
2. From the DOS prompt in the FDR directory, type and enter

WIMS2PC wims_file pc_file

where: **wims_file** is the name of the data file from WIMS, and
pc_file is of the format NNNNNN.FWX, where N...N is the six-digit ID number of the weather station.

Appendix B: PCDANGER Data Files and File Formats

Archived weather and indexes are stored in files named WEATHER.DAT and OBS_NDX.DAT. These files reside in the same directory as the program files.

Archived forecast observation and indexes are stored in files named FORECAST.DAT and FCST_NDX.DAT. These files reside in the same directory as the program files.

Standard NIFMID weather observation file format is as follows:

Field description	Begin column	End column
Station number	1	6
Year	7	8
Month	9	10
Day	11	12
State of weather (code)		13
Dry bulb temperature (°F)	14	16
Relative humidity (percent)	17	19
Herbaceous greenness factor	20	22
Herbaceous vegetation condition	23	24
Human-caused risk	25	27
Wind direction (8 point)		28
Windspeed (mph)	29	31
Woody vegetation condition		32
10-hr fuel moisture (percent)	33	35
Woody greenness factor	36	38
Maximum temperature (°F)	39	41
Minimum temperature (°F)	42	44
Maximum relative humidity (percent)	45	47
Minimum relative humidity (percent)	48	50
Season code		51
Precipitation duration (hrs)	52	53
Precipitation amount (inches)	54	57
Lightning activity level	58	60
Relative humidity variable[a]		61
Forecast flag		79
Region number		80

[a]Relative humidity indicator: 1 = wet bulb temp., 2 = RH%, 3 = dew point temp.

PCDANGER NFDR Components and indexes file format is as follows:

Field description	Begin column	End column
Station ID	1	6
Year	7	8
Month	9	10
Day	11	12
NFDR model system	13	14
Fuel model		15
Slope class		16
Herbaceous type		17
Climate class		18
Woody type		19
1-hr = 10-hr		20
Woody fuel moisture (percent)	21	24
Herbaceous fuel moisture (percent)	25	28
1-hr fuel moisture (percent)	29	31
10-hr fuel moisture (percent)	32	34
100-hr fuel moisture (percent)	35	37
1,000-hr fuel moisture (percent)	38	40
Keetch-Byram Drought Index	41	44
Ignition component	45	48
Lightning risk	49	52
Lightning-caused occurrence index	53	56
Human risk	57	60
Human-caused occurrence index	61	64
Spread component	65	68
Energy release component	69	72
Burning index	73	76
Fire load index	77	80
Staffing class	81	84
Adjective rating	85	87
Industrial precautions class	88	90

Appendix C: Programs Using Historical Fire and Weather Information

Category	Name	Short description	Description	Reference
Fire and weather data	FIRESTAT	Fire Statistics (FS Fire Report 5100-29)	Electronic entry and storage of information from the Forest Service FS-5100-29 Individual Fire Report form. Files are periodically transmitted to the NIFMID data base.	USDA Forest Service 1996b
	NIFMID	National Interagency Fire Management Integrated Database	ORACLE database on the USDA National Computer Center in Kansas City (NCC-KC) which stores historical data on weather (all agencies) and wildfire occurrence (currently only Forest Service).	USDA Forest Service 1993
Data access	KCFAST	Kansas City Fire Access Software	Forest Service DG program. Utility to facilitate access to fire related data and applications at the NCC-KC. It is used to extract fire and weather data from NIFMID and to get the passing file of weather and indexes produced by FIRDAT (+ other uses not related to FIRES).	USDA Forest Service 1996a
	KCFASTPC	Kansas City Fire Access Software (PC)	PC program for access to NCC-KC. Subset of KCFAST. Uses SIMPC communications software to interface with NCC-KC.	
NFDRS calculation from daily weather	WIMS (NFDRCALC)	NFDRS daily calculation on WIMS at NCC-KC	Calculation of NDFRS indexes from daily entry of weather data via WIMS: Weather Information Management System. Weather is archived in the NIFMID data base.	USDA Forest Service 1995
	PCDANGER	NFDRS daily calculation (PC)	Calculation of NFDRS indexes from daily entry of weather data on PC. Weather data can be periodically transmitted to the NIFMID data base for archival. PCDANGER is based on the same NFDRS calculations as NFDRCALC, but is designed for PC and offers additional options. Weather scenarios can be entered for medium range projection of NFDRS indexes.	This publication
Calculation and analysis of NFDRS from historical weather	FIRDAT	NFDRS historical calculation	FIRDAT is one of the programs under the FIREFAMILY name. Calculation of fire danger indexes from archived weather files from NIFMID. A "passing file" containing weather and index values for each day is created.	Main and others 1990
	PCFIRDAT	NFDRS historical calculation (PC)	PC version of FIRDAT. Very few changes to design.	California Dept. of Forestry 1994
Analysis of fire and NFDRS data	FIRES	Fire Information Retrieval and Information System	Merges fire and weather/index files for analysis. Provides summaries, plots, and analyses and aids in determining most representative weather station(s), fuel model, and index for setting staffing levels.	Andrews and Bradshaw, in preparation
Groups of programs	FIREFAMILY	Family of fire danger rating programs for analysis of historical data	FIRDAT—calculation of indexes. SEASON—plots of data generated by FIRDAT.	Main and others 1990
	PCFIREFAMILY	FIREFAMILY programs for PC	Very few changes to design. PCFIRDAT and PCSEASON.	California Dept. of Forestry 1994
	WIMS	Weather Information Management System	Programs and data bases at NCC-KC including NFDRCALC and NIFMID. FIREFAMILY programs can be accessed through WIMS by KCFAST utility.	USDA Forest Service 1995

Appendix D: PCDANGER Source Code

PCDANGER has been compiled with Microsoft Fortran, Version 5.1. The distribution disk contains a subdirectory (FDR_SRC) that contains fully documented source code salient to the computation of NFDRS fuel moistures and indexes. The menu and data screen routines are PC implementations of the Forest Service Applications Toolkit (FSAT) that provide a "CEO look and feel" to application software on the Forest Service Data General systems. The graphing routines use libraries from a third-party vendor. The FSAT and Graphic libraries **are not** included in the source code files.

To extract the source code from the FDR_SCR subdirectory, type and enter:

A:\FDR_SRC\SRC_SEND

The source code files are expanded from drive a: into your current working directory. The source code files are internally documented. The files contained in SRC_SEND, and a brief description of their function follows. Files with a .FOR extension contain multiple routines (functions) collected in a function related file. Files with an .INC extension are 'include' files that define variables contained in labeled common blocks.

FDR.FOR	Main Program and data initialization routines.
STN_CAT.FOR	Does all station catalog data entry and validation.
STN_FCST.FOR	Does all weather forecast data entry and validation.
STN_OB.FOR	Does all weather observation data entry and validation.
CURING.FOR	Live fuel moisture computations.
NFDRCALC.FOR	Dead fuel moisture and index computations.
READ_WX.FOR	Reads weather observations from files.
CATALOG.INC	Include file defining all variables in the station catalog file structure.
STN_COMS.INC	Include file defining pointers into station catalog screen.
FCST_COM.INC	Include file defining pointers into forecast screen.
WX_CAT.INC	Include file defining station catalog objects needed for NFDR computaions.
WX_COMS.INC	Include file defining pointers into weather observations screen.
WX_OBS.INC	Include file defining weather elements (observed or forecasted) for weather observations into NFDRCALC.
FDR_FUEL.INC	Include file for fuel model parameters.
NDX_COMS.INC	Include file defining index structure for passing between routines.

Appendix E: Software Availability

You may obtain a current version of PCDANGER software from the National Fire and Aviation Management (F&AM) Support Helpdesk. You may also download it from the USDA Forest Service Weather Information Management System (WIMS). Contact information is:

F&AM

DG Message: FIRE?:W02A
E-Mail: /s=FIRE?/ou1=W02a@mhs-fswa.attmail.com
Telephone: 1-800-253-5559

WIMS

SFILE PGRMS
Filename FDR_SEND.EXE (Self-Extracting Distribution File)

Bradshaw, Larry S.; Law, Erin M. 1997. User's guide to PCDANGER: National Fire Danger Rating System for personal computers. Gen. Tech. Rep. INT-GTR-366. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 16 p.

PCDANGER is a personal computer application of the National Fire Danger Rating System (NFDRS) that calculates both 1978 and 1988 version fire danger indexes from daily weather observations and forecasts. Its computational routines (NFDRCALC) are the same as those used in the Weather Information Management System (WIMS), which is the current national system in the United States for daily computation of NFDRS components and indexes. PCDANGER replaces the former PC-based fire danger rating application NFDRSPC.

Keywords: WIMS, fire weather, NFDRSPC

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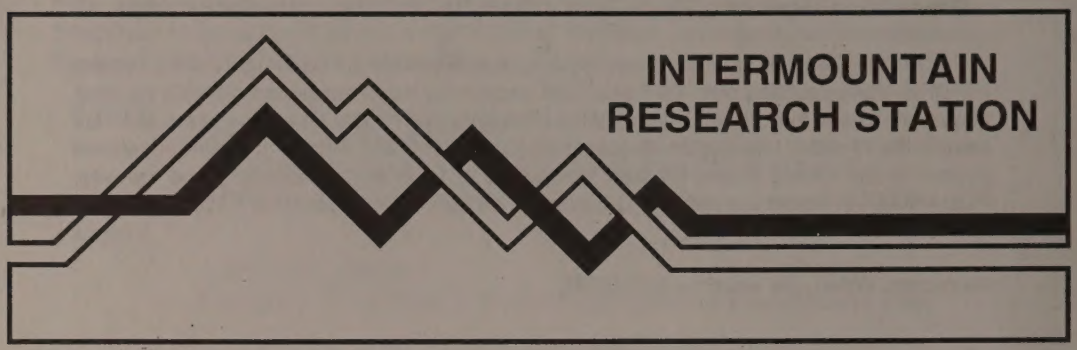

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